SHAPES AND TOPOGRAPHY OF GALILEAN SATELLITES FROM GALILEO SSI LIMB COORDINATES. Peter C. Thomas (Cornell, thomas@cuspif.tn.cornell.edu), D. Simonelli (Cornell), J. Burns (Cornell), M. E. Davies (Rand), A. S. McEwen (LPL), M. Belton (NOAO), and the Galileo SSI Team.

INTRODUCTION

The excellent performance and calibration of the Galileo SSI system allow for detailed measurements of limb coordinates of the Galilean satellites for determination of biaxial shapes and local topography. Overall shape parameters such as conformity to equilibrium ellipsoids and the difference in long and short axes helps constrain possible interior models. Determination of local topography at a variety of wavelengths especially on Io, is useful in many geologic investigations where slopes, scales of supported loads, and erupted and eroded volumes are important. Limb coordinates can be measured to about 0.1 pixels in the image plane by modelling fall off of signal from the satellite limb. Limb profiles of 140° or more are useful in assembling an overall shape. Limbs of almost any length can give topography on the limb "envelope."

SHAPE RESULTS:

Io: For Io the triaxial solution is a = 1830.0 ± 2.5; b = 1819.5 ± 1.5; c = 1816.25 ± 1.5 km; mean radius = 1821.9 ± 1.8 km; a–c = 13.75 ± 2 km. Error bars reflect uncertainties in limb measurement, as well as uncertainties induced by topography and incomplete sampling. The Io shape is very close to that measured by Gaskell et al. [1]. The shape parameter (b–c)/(a–c) = 0.24 ± 0.05 is indistinguishable from the expected equilibrium value of 0.246, and the nominal a–c suggests internal differentiation, in agreement with gravitational results of Anderson et al. [2].

Europa: A limited number of images are useful for Europa, though this situation will be improved greatly if there is a Galileo Europa Mission. The present solution is a = 1563 ± 1; b = 1561 ± 2; c = 1559.5 ± 1 km; a–c is 3.8 ± 0.7 km. The latter quantity for a homogeneous Europa (density of 3.01 g cm^{-3}) would be 3.9 km.

Ganymede: So far only a sphere can be fit with a mean radius of 2631.5 ± 2 km.

Callisto: Galileo data so far include only small arcs of limbs.

TOPOGRAPHY:

Io: The vast majority of lengths of limb profiles of Io show less than 2 km of relief, but isolated mountain forms have several km of relief. The largest peak measured so far is the eastern part of Euobea Montes (–47, 347°W), which reaches about 11 km above the surrounding plains. Flank slopes on this and many other isolated peaks are typically 5° to 8°. Longer wavelength topography (1000 km) appears to reach 2 km in amplitude, though more limb profiles, and incorporation of good Voyager profiles, are needed to map out these features, and to test regional correlations of topography, geology, and heat flow such as proposed by McEwen, 1995 [3].

Europa: Limbs of Europa are extremely smooth andl have mean deviations from ellipses of less than the image noise, which in the best instance so far is ~50 m. Future images may give limits to topography of 10–1000 km of tens of meters amplitude that may help limit rheological properties of the Europan crust.

Ganymede: Most limb topography is well under 2 km, and with limited views so far has not been correlated with geologic features.

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